Lead-Based
Operations and Maintenance Work

Training Manual

SISC

SELF-INSURED SCHOOLS OF CALIFORNIA
Safety and Loss Control

A program operated by the
Kern County Superintendent of Schools Office
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Preface

This manual was developed as a training adjunct to help fulfill the OSHA training requirements for lead-based construction work. It is not intended, nor should it be used as, a substitute for classroom instruction.

This manual and the associated instruction are intended for employees conducting routine maintenance operations involving lead. Large-scale lead removal projects or lead hazard abatement must be conducted by certified individuals. This information and training does not satisfy certification requirements.

Any questions or comments regarding the content of this training manual should be directed to the SISC Safety and Loss Control office.

History and Sources of Lead Use

Lead is a heavy, soft bluish metal that is found near the surface of the earth. Lead generally occurs in nature as ores, and was recovered in early times as a byproduct in the smelting of silver. Once lead is mined, processed, and introduced into the environment, it is a potential problem forever.

The history of lead use can be traced back many centuries. The oldest known lead object is a statue dated 6500 B.C. that was excavated in Turkey. Lead objects have been found in Egyptian tombs, and in ancient Syria lead was used as a means of currency. Lead has been mined, smelted, and compounded for thousands of years. During the Roman Empire, lead was used to line vessels that stored water and wine, to make utensils, and as a glaze on pottery. It is hypothesized that lead poisoning, which caused lower birth rates and increased mental disturbances, contributed to the decline of the Roman Empire.

World production of lead 4000 years ago has been estimated at 160 tons per year; 2700 years ago it was 10,000 tons per year; and during the Roman Empire, lead production increased to 80,000 tons per year.

The ancient Greeks were the first to write about lead poisoning, but for most of lead's long history it was not suspected as a hazard. Over the years, doctors have used lead as a "treatment" for various diseases. A medical dictionary dated 1745 suggests that lead dissolved in a mild acid such as vinegar might be used to cure sores of skin diseases. Others claimed that lead therapy could cure consumption, diabetes, dysentery, and epilepsy.

Centuries of mining, smelting, and use have released millions of tons of lead into the environment. With the advent of the industrial age in the 1800s, the use of lead increased and with it, the potential for occupational exposures. Its versatility, as well as favorable physical and chemical properties, accounted for its extensive use. Much of its usefulness is due to its plasticity and softness. Lead can be rolled into sheets that can be made into rods and pipes. It can be molded into containers and mixed with other metallic elements. Lead has been used extensively in building construction, especially roofing, cornices, electrical conduits, and water and sewage pipes.

Sources of Lead Contamination

Lead contamination occurs naturally in small quantities on the earth's crust, but the greatest risk of lead contamination comes from man-made processes and products. Though the use of lead in manufactured products has been substantially reduced or eliminated, the effects of the products installed before the reduction or elimination remain in the environment.

The major source of lead for most adults is occupational exposure. For infants and young children, however, surface dust and soil are the major lead hazards, primarily because young children play on floors and in outside play spaces that may be contaminated with lead. They frequently put fingers, toys, and other objects in their mouths, thereby ingesting the lead. Surface dust and soil exposure pathways are often derived from lead-based paint. Air is a less important pathway for exposure although lead may be in airborne dust during refinishing or renovation activities or because of windblown surface dust. Also, children are often exposed to lead that is brought into the house on the work clothes of parents.

An individual may become poisoned through exposure to a single high-level source or through the cumulative effect of repeated exposure to several low-level sources. High-level exposures can occur through an occupational route, or through an environmental route, such as deteriorated paint in the home. High-level or acute lead exposures can be severe, resulting in convulsions, coma, and even death.

Experts agree there are three major sources of lead exposure today: (1) lead-based paint, (2) urban soil and dust (deposits from paint, gasoline, and industrial sources), and (3) drinking water, primarily from leaded solder, brass fittings and fixtures, and service lines. These sources are considered major because many people are generally exposed. Contributions from other sources add to the problem and are, therefore, of potential concern.

Lead in Paint

Archaeologists have found lead pigments on buildings as old as 3000 B.C. Lead's longevity helps explain why it was used as a paint additive. The lead content was a measure of quality; for example, the higher the lead content, the better the paint.

The amount of lead-based paint (LBP) in housing is significant; tens of millions of housing units contain at least some lead-based paint. Buildings with chipping lead-based paint and protruding surfaces with lead-based paint are avenues of lead exposure for children. The common route of exposure, however, is the ingestion of lead-bearing dust generated when paint deteriorates, chalks, or is disturbed through renovation or abrasion from the opening and closing of windows.

There is an association between the presence of lead-based paint and the presence of excessive levels of lead in dust and soil in surrounding areas. The foremost cause of childhood lead poisoning in the United States today is from lead-based paint and the accompanying contaminated dust and soil.

The mechanism by which children ingest LBP is often normal hand-mouth activities. Infants and toddlers frequently place fingers and toys in their mouths, or they may chew on other objects such as sills, railings, etc. If these items are contaminated with lead, then the child becomes exposed.

By 1904, the use of lead in paint was either banned or discouraged in France, Germany, and Australia. However, the United States did not regulate LBP until 1978 when it was banned for residential and commercial use.

Lead in Surface Dust and Soil

Surface dust includes both house dust and street dust. Surface dust and soil can become contaminated with lead by weathering and chipping of lead-based paint, from scraping and sanding of lead-based paint in preparation for refinishing, and from renovations that break surfaces painted with lead-based paint. Other potential sources of lead dust include abrasion on doors and windows, atmospheric fallout from the combustion of leaded gasoline (deposited before the phase-down) factory emissions, dust and dirt carried into the home by pets or on shoes and clothing--especially shoes and clothing from factories or construction sites that are contaminated with lead.

Several studies published during the past two decades by the U.S. Environmental Protection Agency (EPA), the Agency for Toxic Substances and Disease Registry (ATSDR), and the University of Cincinnati have confirmed an association between dust lead levels and childhood blood lead levels. Blood lead levels generally rise from three to seven micrograms per deciliter (ug/dl) for every 1,000 parts per million (ppm) increase of lead concentration in soil or dust. It is important to note that particle size and the chemical form of lead affect the bioavailability of lead in dust and soil. Access to soil, behavior patterns, presence of ground cover, and a variety of other factors also influence the relationship between soil/dust lead and blood lead levels.

Approximately 14% of all housing units built before 1980 have lead in the interior surface dust that exceeds the levels recommended in the *HUD Interim Guidelines*. The chance of a home having excessive lead dust is about twice as great if the home has high levels of interior lead-based paint than if it does not. However, most of the homes with interior lead dust have it only on the windowsills or in the window wells. Only about one million units have excessive lead dust exclusively on the floors.

Soil outside of buildings is another direct source of childhood lead exposure and a potential source of lead house dust since soil can be tracked or blown into the dwelling. Approximately 15% of all homes built before 1980 have concentrations of lead in the soil adjacent to the house that exceed 500 ppm. Five hundred (500) ppm is the soil lead cleanup level currently used at Superfund sites, however, in residential settings the EPA is not recommending routine remedial action at this level. The chance of levels greater than 500 ppm occurring is at least four to five times greater if the house has exterior lead-based paint than if it does not. The greatest threat of lead contamination is around the perimeter of the house at the roof dripline. Activity in this area should be restricted if the soil is suspected of being lead contaminated.

Lead in Water

Lead contaminates drinking water primarily through corrosion of materials in the plumbing system. Potential sources of lead in drinking water systems may include:

1. Water service mains (rarely)
2. Lead plumbing goosenecks or pigtails

3. Lead service lines and interior household plumbing, especially where lead solder was used
4. Lead-containing alloys, such as faucets or valves made of brass or bronze

The main cause of lead contamination in drinking water is corrosion of lead-containing materials in household plumbing. In particular, poorly soldered joints where the solder contains lead and accumulations of brass fittings may produce high levels in the water. The amount of lead in drinking water attributable to corrosion depends on several factors, including the amount and age of lead-containing materials susceptible to corrosion, the amount of time the water is in contact with these materials, and the corrosiveness of the water.

Water corrosiveness is determined by its acidity, temperature, and total dissolved solids. Hot, acidic, *soft* (low in dissolved solids) water is the most corrosive with regard to lead. Conversely, cold, alkaline, *hard* water is the least corrosive. New solder and brass fittings will release more lead into the water than other ones primarily because of the formation of mineral deposits. As time passes, mineral deposits form a coating on the surface of the pipes, faucets, etc. The coating insulates the water from the lead, which decreases the rate of corrosion.

The amount of time water stands in the plumbing system is also a factor in lead accumulation. Thus, water stagnant in the plumbing overnight typically has higher lead levels than flushed water.

Lead in water can contribute significantly to a child's overall lead exposure. For an average 2-year old child, drinking water contributes about 20% of the total lead exposure. The proportion of lead exposure attributable to drinking water varies with different levels of lead in the water and with variation of other lead exposures. Drinking water may contribute from 5% to more than 50% of children's total exposure. Infants whose diets are dependent on formula may receive more than 85% of their lead from drinking water.

Lead in Air

There have been significant reductions of lead contamination in the air over the past fifteen years primarily because of the phase-down in the use of leaded gasoline. The National Health and Nutrition Examination Survey showed a correlation between the reduction of lead in air and the decline in childhood blood lead levels between 1976 and 1980. The EPA reports that total atmospheric lead emissions dropped 94% between 1978 and 1987 due to the phase-down of leaded gasoline, the introduction of unleaded gasoline in new cars, and attrition in the supply of vehicles that burn leaded gasoline.

Air can also be contaminated by emissions from stationary sources, such as smelters and battery factories and from the combustion of oil, coal, waste oil, and municipal wastes. Windblown dust is another source of air contamination. However, lead emissions from industrial and other stationary sources have declined because of compliance with regulations aimed at achieving national air quality standards.

In the occupational setting, lead in air is a significant problem at many worksites, especially where renovation, lead abatement, and painting of bridges or other steel structures are conducted. The National Institute of Occupational Safety and Health (NIOSH) reports that workers are frequently poisoned by lead while working on bridges (a high percentage of bridges are painted with lead-based paint). Operations such as abrasive blasting, sanding, burning, or welding on steel structures coated with lead-containing paints may produce very high concentrations of lead dust and fumes.

Lead in Food

Food can be contaminated by deposits of airborne lead onto crops or water, during transportation or processing, or from containers with lead solder, lead glaze or other materials containing lead. In food processing, the primary source of lead has been solder in the seams of cans. A phase-out of lead solder in cans began in the late 1970s, resulting in a significant reduction in lead in canned food. The Food and Drug Administration (FDA) has developed a comprehensive plan to address lead exposure through food and food-contact surfaces in the United States. However, imported canned foods may still contain lead solder. Pottery and ceramics, plates and crystal (especially imported pieces) may contain high levels of lead. Also, some home remedies popular in certain ethnic communities contain high levels of lead. Examples of such remedies include Azarcon, Pay-loo-ah, Greta, Ghasard, Bala Goli, Kandu, Kohl, and Alkohl.

Other Sources

Although discussions concerning lead poisoning are often focused on children, adults also are affected by lead. Adults who work in certain industries, such as smelting, auto body repair and painting shops, and construction (including lead abatement), can be at risk. Moreover, they may carry lead-contaminated dust into their homes on work clothes, shoes, and hair, if care and precautions are not taken. Proper personal hygiene and work practice precautions should be followed. Hobbyists working with stained glass or pottery, and sportsmen who make their own bullets or fishing weights, should exercise caution to minimize lead exposure.

Asbestos Versus Lead

Similarities

- Both involve very small particles and can be disturbed to the point that the hazard can become worse.
- Both are respiratory hazards and require respiratory protection at their respective permissible exposure limits, using HEPA filters.
- HEPA vacuums are required when conducting cleanup or during abatement.
- Both can have severe negative health effects.
- Dust or residue from both can contaminate adjacent areas.
- Abatement in schools must be conducted by certified personnel.
- Clearance tests and limits are established for both to determine abatement completion.

Differences

- Blood lead levels indicate whether there has been excessive exposure. There is no test to determine asbestos exposure.

- Ingestion of lead is generally more of a risk than inhalation. Asbestos is a concern only from an inhalation standpoint.
- Lead is much heavier and is not as likely to migrate through the air. Asbestos fibers can stay airborne for long periods of time.
- Lead can cause acute severe health effects. Asbestos can cause chronic health effects.
- Exposure to lead will not cause cancer. Asbestos is documented as a carcinogen.
- Tens of thousands more individuals suffer adverse health because of lead than from asbestos.

Work Practices

Accurate testing and inspection is more difficult for lead than it is for asbestos. There are many areas where lead is found and sampling is necessarily more extensive and time consuming. Although HEPA vacuums, respirators, and protective clothing are required with lead work, actual containment is less rigid. With asbestos, clearance is achieved through air samples, while dust wipe samples are taken to determine if a lead work area is clear for occupancy. Asbestos is already heavily regulated, while lead is becoming increasingly more regulated. There are potential major legal liabilities associated with both asbestos and lead.

Lead Sampling and Measurement Units

When sampling for the presence of lead, many types of samples can be taken. The testing procedures vary depending on the testing medium, such as water, paint, soil, etc. Each testing procedure produces a result with a specific measurement unit and regulatory limit. These measurements can be confusing, however, they are important to understand in order to meet safety and health standards and/or to assess lead hazards.

Paint Chip Sampling

Paint chip samples are the easiest and most common type of samples taken to determine the lead content of paint. Paint chips are usually taken when relatively few samples are desired. The samples are collected by scraping paint down to the substrate. It is important to avoid creating dust or debris while collecting samples as contamination can result. If paint cannot be easily scraped, the use of a heat gun to peel the paint is an acceptable method of gathering a sample. Only one gram, approximately one tablespoon, of paint is needed for a valid sample result. Results of paint samples are generally expressed in percent by weight. However, results can also be reported in parts per million (ppm).

What is the definition of lead-based paint? According to Housing and Urban Development (HUD) guidelines, paint with a lead content of 0.5% by weight or 5,000 ppm is considered lead-containing, while the Consumer Product Safety Commission (CPSC) considers paint at or greater than 0.06% by weight (600 ppm) to be lead-containing. However, for workers, Cal-OSHA Title 8, Section 1532.1 applies when any amount of lead is present, whatever the level.

XRF

X-ray fluorescence (XRF) testing is a method commonly used when numerous samples will be taken. The detector uses a radiation source that is exposed to the surface and a reflected radiation pattern is read by the meter. The reading is usually displayed as a digital readout and reported in milligrams per square centimeter (mg/cm^2). This particular piece of equipment works well on flat surfaces and does not affect or damage painted surfaces. However, it does not work well on curved or uneven surfaces.

Paint is considered lead-containing by HUD guidelines when a reading of 1.0 mg/cm^2 or greater is achieved. XRF sampling is fast and fairly accurate. However, there is an inconclusive range at lower levels that must be verified through paint chip analysis.

Dust Wipe Sampling

Surface dust wipe sampling is the method of choice for evaluating surface contamination and for clearance after abatement. These samples are usually collected using commercial baby wipes or hand wipes. A one square foot area is marked off, then wiped in an "S" motion, then wiped again using the same motion but perpendicular to the first wipe pattern. Dust sample results are reported in micrograms per square foot (ug/ft^2). HUD and EPA clearance levels for specific interior surfaces are as follows:

- Floors--l00 ug/ft^2
- Window sills--500 ug/ft^2
- Window wells--800 ug/ft^2

Soil Sampling

Soil samples are generally taken in outdoor play areas, along the building foundation where paint may have chipped off the building, along the drip line, in sand boxes, or any other area where one might suspect there could be lead in the soil. These samples are usually taken as composite samples with three to ten subsamples collected at distinct locations. If paint chips are present in the soil, they generally will be included. However, there should be no special attempt to include the paint chips. Approximately one to one and one-half cup of soil is needed for analysis. Results are reported in parts per million. According to the EPA, levels of lead below 400 ppm are not considered a hazard. Interim control methods should be taken at levels above 400 ppm if children are present.

Water Sampling

Local water authorities are required to monitor lead levels in the water they supply. If there is a concern that lead may be leaching into the water between the service line and the faucet, water samples can be taken. Approximately one liter of water should be drawn as a first draw after the water has remained in the pipes for at least six hours. Results of water sampling are reported in parts per billion (ppb). The EPA's action level is 15 ppb. Often, the simplest way to reduce lead in drinking water is to flush the water lines in the morning by letting the water run for a minute or two. This procedure will help only if the lead source is the plumbing line and not the service line.

Air Sampling

Personal air monitoring must be conducted to insure compliance with airborne limits established by OSHA. These samples are taken using a small vacuum pump and placing an air filter cassette in the worker's breathing zone. The pump is then operated for a specific amount of time and at a specific rate. The amount of air that passes the filter can then be calculated. Results are reported in milligrams per cubic meter (ug/m^3). OSHA's action level is 30 ug/m^3 and the permissible exposure limit is 50 ug/m^3.

Blood Sampling

Blood lead level tests and tests for zinc protoporphyrin (ZPP) must be made available for anyone who may be exposed above the action level. They involve taking a sample of the worker's blood and having it analyzed by a laboratory. The level of lead in the worker's blood can indicate a possible health risk and may force an employer to limit the worker's exposure to lead. Blood sample results are reported in micrograms per deciliter of blood (ug/dl). OSHA requires further attention and follow-up blood testing when levels are above 40 ug/dl. At 50 ug/dl, medical removal is required

Children are also tested for blood lead levels because of the damage that high lead levels can cause to their developing brain and nervous systems. According to the Centers for Disease Control (CDC), the level of concern and the definition of an elevated blood lead level in children is 10 ug/dl while the CDC's action level for children is 20 ug/dl.

Regulatory Standards and Units of Measurement

Paint Chip Samples
.5% or 5,000 ppm (HUD, EPA)
.06% (CPSC) or 600 ppm

Water Samples (EPA)
no hazard, <15 ppb

XRF Readings (HUD, EPA)
1.0 mg/cm^2

Soil Samples (HUD, EPA)
<400 ppm, no hazard
400-2,000 ppm, interim controls for children
2,000-5,000 ppm, interim controls for adults
>5,000 ppm abatement (remove or cover)

Dust Samples (HUD, EPA)
Floors, <100 ug/ft^2
Window sills, <500 ug/ft^2
Window wells, <800 ug/ft^2

Blood Samples
Children (CDC):
Level of concern, >10 ug/dl
Action level, 20 ug/dl

Air Samples (OSHA)
Action level, 30ug/m^3
PEL, 50 ug/m^3

Workers (OSHA)
Action level, 40 ug/dl
Medical removal,>50 ug/dl

Meter (M or m) - measure of length or area 1 m = 39.37 inches

"Centi" means 1/100 (one hundredth); centimeter (cm) means one meter divided by 100

"Milli" means 1/1,000 (one thousandth); millimeter (mm) means one meter divided by l,000 Liter - approximately one quart

"Deci" means 1/10 (one tenth); deciliter (dl) means one liter divided by 10 or approximately 3 oz.

Gram (g) means measure of mass or weight (a nickel weighs about one gram) 28.4 grams = 1 oz.

"Kilo" means 1,000 times; kilogram (kg) means 1,000 grams

"Micro" means l/l,000,000 (one millionth); microgram (ug) means one gram divided by 1,000,000

Parts per million (or billion) (ppm, ppb) number of parts of lead per one million (or billion) parts of the whole sample. 1,000,000 ppm =100%.

Area square foot (ft^2), square centimeter (cm^2)

Volume meter cubed (m^3), centimeter cubed (cm^3)

Lead Regulations

There are a number of agencies that are involved in the regulation of lead. The agencies and a summary of their regulations are as follows:

OSHA Lead Exposure in Construction Standard (Federal OSHA: 29 CFR 926.62) (Cal-OSHA: 8 CCR 1532.1):

Both Fed-OSHA and Cal-OSHA regulate lead exposure in construction. Cal-OSHA adopted the federal standard several years ago (1993) and has yet to finalize its own version.

The standard applies to all employees involved in construction related activities, including demolition and maintenance, who may be exposed to lead products. Various levels of training and work practices are mandatory. The standard also requires alt employers of covered employees to provide an exposure assessment of the possible exposure to lead hazards. One component of the mandatory exposure assessment involves sampling the air in a worker's breathing zone to determine lead exposure. An Action Limit (AL) and Permissible Exposure Limit (PEL) has been established. Personal air sample results are then compared to the AL and PEL; exceeding these levels triggers various requirements.

The standard also addresses when employees must wear personal protective equipment, such as protective suits and respirators, when they must follow mandatory hand-washing procedures and when full-body showers are required. Employers must make available medical exams for workers as well as testing for blood lead levels There are provisions for removing workers. With high blood lead levels from jobs involving lead exposure.

Covered Work

Construction and related work are covered whenever employees may be exposed to lead. Construction work is defined as work for construction alteration. and/or repair, including painting and decorating. Specific examples include:

1. Demolition or salvage of structures where lead or materials containing lead are present
2. Removal or encapsulation of materials containing lead
3. New construction, alteration. repair, or renovation of structures, substrates, or portions thereof that contain lend or materials containing lead
4. Installation of products containing lead
5. Lead contamination/emergency cleanup
6. Transportation, disposal storage, or containment of lead or materials containing lead on the site or location where construction activities are performed
7. Maintenance operations associated with the construction activities listed above

Exposure Assessment

Every employee who has a workplace covered by the lead standard must assess whether the employees are exposed at or above the action level. This may be done by conducting personal air sampling, using relevant historical sampling results, or other "objective" data. The assessment has to be redone whenever a change in work conditions may change lead exposure. Objective data arc not permitted to be used for exposure assessment purposes for the tasks listed below.

In addition, there arc various tasks, such as sandblasting. where certain work practices and personal protective practices are mandatory while the initial exposure assessment is being conducted. These tasks are called "trigger activities" and include the following:

Group 1 Tasks: Manual demolition of structures, manual scraping, manual sanding, heat gun applications, and power tool cleaning (with HEPA filters) These tasks are considered to have an anticipated exposure level of 50-500 ug/m^3 .

Group 2 Tasks: Using lead mortar, lead burning, rivet busting, power tool cleaning without dust collection systems, cleanup activities for dry abrasives debris, abrasive blasting enclosure movement and removal. These tasks are considered to have an anticipated exposure level of 500-2,500 ug/m^3

Group 3 Tasks: Abrasive blasting, welding, cutting, and torch burning. These tasks are considered to have an anticipated exposure level above 2,500 ug/m^3 .

All of the above activities require:

- Respiratory protection (see respiratory protection section for specific requirements)
- Mandatory hand washing
- Personal protective clothing and equipment
- Training
- Initial medical surveillance, including a blood test

Action Level (AL) and Permissible Exposure Limit (PEL)
The standard requires air monitoring to determine the lead exposure in the worker's breathing zone. The results of the samples are then compared to the AL and the PEL. The AL is 30 ug/m^3 and the PEL is 50 ug/m^3 .

There are various requirements that must be followed if the AL and/or the PEL are exceeded. Even if an employee is exposed over the AL for one day. the following requirements must be met periodic personal air sampling. biological monitoring (including. blood test), and training. If the exposure is over the AL for more than thirty days in a year, the employer must provide a full medical surveillance program.

If the exposure is expected to exceed the PEL, several other requirements must be met, including the following:

1. Develop a written compliance program
2. Provide protective clothing, including coveralls. gloves, hats, shoes or disposable coverlets, face shields, etc.

3. Provide hygiene facilities including change areas, at least hand washing facilities and showers where feasible
4. Provide eating facilities
5. Enforce mandatory hand washing practices

6. Implement work practices, including engineering controls
7. Provide warning signs

The standard recognizes that the exposure to lead during the work day may vary. Therefore, the AL and PEL are based on an eight-hour time-weighted average. This simply means that the air sampling result is averaged over the entire work shift (even if the worker was not exposed to lead for part of the shift). For example, a worker could be exposed to a small amount of lead for eight hours and have the same sampling result as another worker who was exposed to a lot of lead for one hour, but none for the remainder of the shift.

Compliance Program

Employers who may expose workers above the PEL must develop a written compliance program before the start of each job. The compliance program provides details on how the employer will assure that employees will not be exposed above the PEL. The compliance program must be completed before the start of each lob. The program must be written and include:

1. A description of each activity, including materials, controls, crew size, operating procedures, etc.
2. A description of the specific means used to reduce exposures below the PEL
3. Air sampling data
4. A schedule for implementation of the program
5. A description of work practices, which includes hygiene, personal protection and housekeeping procedures
6. A description of arrangements regarding notifying other contractors
7. An inspection schedule by a competent person

The compliance program must be updated every six months.

Medical Surveillance

The employer must make available medical surveillance for any worker who may be exposed above the AL, even if exposed for only one day. Initial medical surveillance must, at a minimum, consist of a blood test to determine the amount of lead in the worker's blood.

The employer must also make available a medical surveillance program for any employee exposed over the AL for more than thirty days in a year. The medical surveillance program consists of blood lead testing as welt as medical exams by or under the supervision of a licensed physician. The examination must include: a detailed work and medical history, a thorough physical exam., a blood pressure measurement, a blood sample analysis, urinalysis, and any other tests the physician deems necessary. In addition, an employee may request a pregnancy test or laboratory evaluation of male fertility.

A complete discussion of medical surveillance and medical removal is covered in another section.

OSHA Hazard Communication Standard (8 CCR 5l94)

Employers who use hazardous materials must develop a compliance program that includes:

1. Hazard determination
2. A written hazard communication program
3. Warning labels
4. Material safety data sheets
5. Employee training

Because lead is considered a hazardous material, this program is mandatory for lead-related activities.

Injury and Illness Prevention Program (IIPP) (8 CCR 3203. 15O9)

Every employer in California shall establish, implement and maintain the following in writing:

1. Identification of responsible persons
2. A system for ensuring compliance
3. A system for communicating with employees
4. Procedures for identifying hazards
5. Training
6. Records maintenance

In addition to the above, section 1509 of the construction standard includes the following:

1. Adoption and posting of a code of safe practices
2. Having periodic safety meetings for supervisors regarding safety
3. Supervisor conducted safety meetings for workers at least every ten days

California Department of Health Services (17 CCR Chapter 8)

The Department of Health Services (DHS) has implemented a comprehensive regulation that provides an accreditation process for lead-training providers It also provides a certification program for individuals.

The new DHS regulation is the first in a series of regulations designed to protect California residents from lead poisoning resulting from lead-related construction work.

First, DHS addresses training and individual certification for work in public, commercial, and residential buildings. Certification will eventually become mandatory. DHS will also develop work-practice regulations for inspection and lead-related construction work. At that point, several years from now only certified individuals will be able to perform these functions, and they will be required to follow specific work practices.

After November 1, l994, only training providers accredited by DHS are allowed to offer the approved training courses that are requirements for individual certification. Individuals may obtain interim certification as one or more of the following: Inspector/Risk Assessor, Supervisor, Worker, Project Monitor, and Project Designer.

DHS has established training, experience, and education requirements for each discipline listed below:

- Inspection/Assessment: 40-hour course
- Worker: 32-hour course
- Supervisor/Project Monitor: 40-hour course
- Project Design: 56-hours course (40 of the 56 hours are from the supervisor course)

Radiation Safety (17 CCR Chapter 15)

The DHS also has training and licensing requirements for individuals using radioactive devices in California. This includes the use of X-ray fluorescence instruments (XRFs) for lead paint inspection. The training requirements are outlined in CCR Title 17, Chapter 5, subchapter 4, sections 30100-30355. There is a great deal of uncertainty about who may offer this training. Currently, the DHS requires individuals who will utilize XRF instruments to attend the instrument manufacturer's course. Individuals must show proof of that training before they can be added to the licensed operator's list of people allowed to use the XRF.

California Environmental Protection Agency (2 CCR):

Cal/EPA is the state agency responsible for determining when lead paint waste is a hazardous waste and how it must be disposed of. The management of lead waste is a very complicated and confusing issue. In general, Cal/EPA testing procedures are substantially more stringent than the federal requirements, but the disposal requirements are less restrictive.

Procedures for the identification, management, transport, record-keeping, and disposal of all types of hazardous waste are set forth in Title 22, CCR Sections 66260-66263.12 and 66268.1 - 66268.124 and in the Health and Safety Code Section 25163 subdivision (c).

In brief, suspected hazardous waste must be tested. The federal test for lead is the Toxicity Characteristic Leaching Procedure (TCLP). If the result of this test is equal to or greater than 5mg/l of lead, it is considered a hazardous waste.

California requires two different tests to be conducted. The first, SW-846, tests for total lead in the material. It looks for both soluble and nonsoluble lead. The total threshold limit concentration (TTLC) for lead is less than or equal to 1,000 mg/l. The second test is similar to the federal TCLP test but is considered more stringent for inorganic materials. The California test for soluble lead is called Waste Extraction Test (WET). The soluble threshold limit concentration (STLC) for lead using this test is the same as the federal TCLP test. It is less than or equal to 5 mg/l.

Federal Environmental Protection Agency (EPA)

The federal EPA is also very involved in lead regulation development. The following summary mentions a few of the issues addressed by the EPA:

1. The EPA is developing a model training and accreditation program for states. The draft was released in 1994. The final program will be implemented sometime in 1996 in states that have not adopted a program that the EPA accepts as equally protective. California will adopt the DHS accreditation program, and it is expected that the EPA will accept the program as meeting the requirements.

2. Along with HUD. the EPA released a draft of a disclosure pamphlet titled *Lead Hazard Information Pamphlet*. Owners must provide the pamphlet to buyers and renters of privately owned housing built before 1978. Distribution of the disclosure pamphlet became mandatory the fall of 1995. In addition, home remodeling contractors will have to provide owners with this or a similar EPA pamphlet before beginning remodeling activities. Along with the Consumer Product Safety Commission (CPSC), they are developing educational information to be distributed by retailers of home improvement products.

3. In addition, the EPA will develop guidelines for renovation and remodeling work involving lead paint. It will promulgate regulations that identify lead hazards in dust and soil. And it will develop a lab accreditation program for those testing for lead. It will also develop performance standards for tools and processes used in LBP inspection and removal work.

Housing and Community Development Act of 1992 (Title X)

In early October 1992, the U.S. Congress combined a variety of bills into one comprehensive body of legislation called the Housing and Community Act of 1992. It was also called the *Title X* Residential Lead Based Paint Hazard Reduction Act of 1992. It is commonly referred to as *Title X (Title 10).*

This law delegated tasks to several federal agencies, including demanding that various agencies (such as EPA and OSHA) develop regulations to implement aspects of this law.

One of the most important aspects of *Title X* is that it redefined the concept of lead hazard. A hazard is defined as" any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, and lead-contaminated paint that is deteriorated or present on accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects."

Other important aspects of *Title X* include:

1. Grants were established to help states develop training and certification programs.
2. OSHA was given 80 days to develop a construction standard for lead.
3. Evaluation programs were created for work done in federally assisted housing programs.
4. Disclosure, risk assessment, inspection, and hazard reduction measures must be conducted in pre-1978 federally assisted project-based housing.
5. All federal agencies, including the Resolution Trust Corporation, selling pre-1960 housing must inspect and abate lead-based paint hazards before property sale or transfer and to inspect housing built between 1960-1978.
6. Purchasers of all pre-1978 housing must be given an EPA lead hazard information pamphlet, and landlords must disclose the presence of known lead-based paint.

HUD Guidelines

Title X required HUD to develop guidelines for federally supported work involving risk assessments. inspection, interim controls, and abatement of lead-based paint hazards. HUD asked the National Center for Lead-Safe Housing to develop new guidelines to replace existing guidelines. The new HUD guidelines, completed in 1995, are called *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.* They are more commonly known as the *New HUD Guidelines*.

The HUD guidelines were developed to help HUD agencies deal with lead paint problems. However, they are guidelines and not regulations. Various HUD guidelines required housing authorities to take certain actions, and when those actions were taken, the agencies were expected to follow specific procedures identified in the HUD guidelines. In essence, the guidelines became standard practice.

These guidelines also have an influence over work done in non-HUD housing. They provide guidance on how activities should he done and why certain procedures are recommended. They are intended to be a working manual of best practices. Currently, the HUD guidelines are considered state-of-the-art in the lead industry.

California Education Code (Article 4, Lead-Safe Schools Protection Act)

32241. Survey to Develop Risk Factors

a. The State Department of Health Services shall conduct a sample survey of schools in this state for the purpose of developing risk factors to predict lead contamination in public schools. The survey shall include schools that are representative of the state by geographical region and size of enrollment. The schools to be surveyed shall be selected on the basis of their ability to provide data necessary to make scientifically valid estimates of the nature and extent of lead hazards. Risk factors shall include, but are not limited to, location in relation to high-risk areas, age of the facility, likely use of lead paint in or around the facility, numbers of children enrolled under the age of six, and results of lead screening programs established pursuant to Article 4.6 (commencing with Section 372) of Chapter 2 of Part 1 of Division 1 of the Health and Safety Code.

b. For the purposes of this article, "schools" means public elementary schools, public preschools, and public day care facilities.
c. For purposes of this article, "public preschools" and "public day care facilities" mean preschools and day care facilities, respectively, located on public school property.

32242. Duties of Department

a. Design and implement a strategy for identifying the characteristics of high-risk schools and provide a basis for statewide estimates of the presence of lead in schools attended by young children.

b. Conduct a sample survey, as described in Section 32241, to determine the likely extent and distribution of lead exposure to children from paint on the school, soil in the play areas at the school, drinking water at the tap, and other potential sources identified by the department for this purpose. To the maximum extent possible, limited sample testing shall be used to validate survey results. The department shall compile and summarize the results of that survey and report those results to the Legislature and the State Department of Education.

c. Within 60 days of the completion of testing a school site, the department shall notify the principal of the school or director of the school site of the survey results. Within 45 days of receiving the survey results, the principal or direction as the case may be, shall notify the teachers and other school personnel and parents of the survey results.

d. Make recommendations to the Legislature and the State Department of Education, based on the survey results and consideration of appropriate federal and state standards, on the feasibility and necessity of conducting statewide lead testing and any additional action needed related to lead contamination in the schools.

e. As deemed necessary and appropriate in view of the survey results, develop environmental lead testing methods and standards to ensure the scientific integrity of results, for use by schools and contractors designated by schools for that purpose.

f. Evaluate the most current cost-effective lead abatement technologies.

g. Work with the State Department of Education to develop voluntary guidelines for distribution to requesting schools to ensure that lead hazards are minimized in the course of school repair and maintenance programs and abatement procedures.

32243. Notice to Parent of Risk Factors

a. When a school subject to this article has been determined to have significant risk factors for lead, the school shall be advised of this finding, and the school shall notify parents of the provisions of the Childhood Lead Poisoning Prevention Act of 1991. Within 45 days of receiving this finding, the school principal or the director of the school site shall notify the teachers, other personnel, and the parents of the finding.
b. Subsequent to the implementation by the state of a certification and training program for environmental lead testing and abatement, any school that undertakes any action to abate existing risk factors for lead shall utilize trained and state certified contractors, inspectors, and workers.

32244. Construction of New Schools: Lead Use Prohibited

Lead-based paint, lead plumbing and so1ders, or other potential sources of lead contamination shall not be utilized in the construction of any new school facility or the modernization or renovation of any existing school facility.

Health and Safety Code (Chapter 10.35, Section 25914.2):

The code states that“ a11 asbestos-related work and hazardous substance removal shall be performed pursuant to a contract separate from any other work, when not disclosed in the bid or contract documents. In the event the contractor encounters asbestos or hazardous substance that has not been rendered harmless, contractor shall immediately cease work on the area affected and report the condition to the owner in writing.”

Health Effects

Lead is similar to asbestos, benzene, formaldehyde or any other substance that was once thought to be a valuable, yet safe, material. What we have learned about lead over the years, however, has shown us that not only is lead a significant health hazard, its use and effects are widespread.

Lead and lead products have been used for hundreds of years, and many of its toxic effects can be traced back equally as far. During the reign of the Roman Empire, most of the pottery was made with lead. There was also significant mining taking place because of the Romans' obsession with military achievement. It is now thought that the demise of the Roman Empire was due, in part to mass lead poisoning.

Also in later years, many expeditions to undiscovered territory were doomed to failure because of lead poisoning. The invention of tinned foods in 1810 allowed for extended travel, which before was impossible because of inadequate food storage capabilities. In 1845, the expedition of Sir John Franklin into the Northwest Passage failed because of lead poisoning (129 men perished). It was originally thought that scurvy, starvation, or just bad luck caused the demise of the crew. However, recent discoveries have led us to believe they died of lead poisoning. Other such expeditions met with the same fate.

Great artists such as Rubens, Renoir, and Dufy were also suspected victims of lead poisoning. These artists used bolder, brighter colors in their work than their counterparts. Because of the lead salts used in the pigments these artists may have been heavily exposed to lead. Each artist is known to have suffered from rheumatoid arthritis, which could have been a result of lead poisoning.

The skeletal remains of these early men have revealed much about lead's potency and tenacity.

Routes of Entry

How does lead get into the system? The routes of exposure include:

1. Ingestion
2. Inhalation
3. Skin absorption

Although inhalation is traditionally the route of exposure that is of most concern, historically ingestion has played a significant role in lead poisonings. Ingestion is the major route of exposure for both children and adults. However, controlling inhalation in the occupational environment is still the primary concern.

Work involving lead paint or lead products can produce fumes (from heating or burning) or particles (from sanding or grinding). When very fine particles or vapors of lead are inhaled with air they act like fumes and can get into the upper airways and the lungs. Larger particles are cleared from the upper airways, swallowed, and absorbed in the gastrointestinal tract. Smaller particles enter the lungs and are absorbed by the lung. In normal adults 30-50% of inhaled lead is retained. The amount of lead absorbed depends on the size of the particle. Of the very fine particles that reach the lowest part of the lungs, a very high amount is absorbed. Vapors or fumes of lead caused by heating lead are almost entirely absorbed by the lungs.

As noted previously, ingestion is the leading route of exposure for both adults and children. After lead particles from dust or chips of paint are ingested, swallowed, and dissolved by stomach acids, the gastrointestinal tract absorbs part of the lead ingested. Lead is then distributed throughout the body much in the same way other nutrients are taken into the system. For adults, about 5-15% of the ingested lead is absorbed, while in young children this number is typically 40-50%.

Diet plays a significant factor in how much lead will be absorbed into the system. Lead mimics calcium, so depending on how much calcium is present in the system will determine how rapidly the body will absorb the lead. When dieting or fasting, the body will be low in nutrients. During this time the body will more rapidly absorb lead because it is trying to absorb nutrients. The same is true for individuals who generally do not eat a healthy diet. Children are especially at risk because their bodies are growing and developing. Their bodies are efficient in absorbing the necessary nutrients for growth and development. Since lead cannot be differentiated from calcium, it is effectively absorbed into the system. This difference in the amount of lead absorbed is one of several reasons young children are harmed more by lead than are adults.

The amount of ingested lead absorbed also depends on the size of the particle. Generally, the smaller the particle, the higher the absorption rate. Fine dusts generated from sanding or grinding of lead-based paint are absorbed more than the same amount of lead in the form of flakes of paint. In addition, fine dust is, in many ways, less noticeable to a child or adult than are flakes or chips of paint and therefore more easily ingested. Dusts can have thousands of parts per million of lead by weight. Studies of children living in high-lead areas showed that when their hands were cleaned using wet wipes, each cleaning removed 20 to 30 micrograms of lead. Lead dusts are a very significant exposure pathway. For children it is the most significant pathway.

Ingestion most commonly occurs in the occupational environment because of inadequate hygiene. Workers who fail to wash before eating or smoking can inadvertently ingest lead dust. In the home, children tend to constantly place objects and their hands into their mouths. In a high-lead environment, this normal activity can cause terrible effects on the child's health.

Skin absorption is less of a problem in the United States today primarily because of the elimination of leaded gasoline.

Biological Effects of Lead

After lead is absorbed into the body, it enters the bloodstream. At first, lead attaches to proteins in the blood that carry it to different tissues or organ systems. Since most of the lead present in the blood is bound to the red blood cell, doctors can tell how much lead a person has been exposed to by measuring the amount of lead in the blood. These amounts are reported as a quantity per unit of volume (usually, this is micrograms [ug] per deciliter, ug/dl).

Lead is distributed to many tissues and organ systems. It's important to remember that lead cannot be destroyed or changed into something else in the body. The amount of lead stored in the body is known as the "body burden" of lead. Among adults, over 95% of the total body stores of lead are found in the bones. For children, about 70% of lead is stored in the bones. Although we measure lead exposure through blood tests, an individual may have a much greater level of lead stored or accumulating in his or her bones.

Once in the body, lead is transported throughout the systems and is stored in the bone, kidney, aorta, liver, and blood. Because lead mimics calcium and binds with proteins, it is difficult to get rid of. The body eliminates the lead primarily through urine and the gastrointestinal tract (feces). Usually when lead exposure exists, individuals are unable to process and excrete the lead as fast as it is absorbed. That is why the body burden of lead increases over time. Until late in life, most people are steadily getting more and more lead in their tissues. Only among the elderly (70 to 80 years of age) does the body lead burden begin to lessen.

The effects of lead on the body are widespread. Lead affects the blood and blood forming system, the central and peripheral nervous system, and the renal system (kidneys).

Blood and Blood Forming System Effects

Lead affects the blood system in several ways:

1. Lead interferes with heme synthesis. (Heme is an important component of the blood which carries oxygen to the body tissues.)
2. Lead lowers the life expectancy of the red blood cells.
3. Lead also interferes with globin synthesis. (Globin is the protein component of the blood.)

These effects can cause an individual to become anemic. When lead is present in the blood, there will be a reduction of hemoglobin, which results in anemia. In adults, anemia is usually seen as severe chronic lead poisoning and at blood levels of 70 ug/dl and higher. Lead has a more severe effect on the blood-forming system in iron-deficient individuals. Generally, children and women are more likely to be iron deficient than are adult men. Therefore, women and children tend to show more severe effects. These effects occur at lower blood levels than in men.

Nervous System Effects

It has been understood only during the past decade just how much the nervous system is affected by lead. That means earlier recommendations on safe amounts of lead in blood were dangerously close to levels now considered very likely to cause mental retardation in children. Because the past ten years have been a period of very rapid change in understanding the toxicity of lead, much if what has been written is now outdated. In the l960s, blood lead levels greater than 60 ug/dl concerned medical care providers. By the l980s, this level was lowered to 25 ug/dl. The Centers for Disease Control recently (1991) reduced the level of concern to 10 ug/dl.

At very high lead levels, a condition known as lead encephalopathy can develop. Warning signs include irritability, headaches, hallucinations, and dullness. Lead encephalopathy can lead to learning disabilities, retardation, and motor damage. The condition is not always fatal, however, it is irreversible. In adults, blood lead levels considered at risk are 120 ug/dl and above. In children the levels considered at risk are 80 ug/dl.

At lower exposures, effects on the peripheral nervous system can occur. These include behavioral changes, visual-motor deficiencies, and cognitive motor function difficulties (coordination, speech, and memory can be affected). These effects can occur at blood levels of 30 ug/dl in children. As with the central nervous system, the damage is irreversible.

Renal (Kidney) Effects

A function of the kidney is to filter substances for elimination and to allow for reabsorption of certain nutrients back into the body. Lead interferes with these functions by altering the metabolism of the kidney. The body can then be affected by the reduction of nutrient reabsorption. The renal effects are most often associated with high, chronic exposures. Most often, once the exposure is stopped, the kidney can function normally again.

Other

Chronic, high exposures to lead have been reported to be linked with high blood pressure and stroke. One researcher has followed two groups of workers occupationally exposed to lead (4,519 battery plant workers and 2,300 lead production workers from smelters) for a number of years. Both groups of workers had significantly more deaths than would be expected by hypertensive disease and chronic renal disease. Some additional studies have shown that blood lead levels within the range found in the general population are associated with increased blood pressure.

Also, female workers with high lead exposures and the wives of male lead workers have a higher rate of miscarriages. Male workers with elevated lead exposures (above 50 ug/dl) have more abnormal sperm cells and lower sperm counts.

Respiratory Protection and Personal Protective Equipment

Personal protective equipment (PPE) and respirators are sometimes necessary to protect workers against chemical and physical hazards. In the case of lead, the primary concerns are protecting the respiratory system and preventing contamination of the worker's clothing . Therefore, the primary pieces of protective equipment include coveralls and respirators. However, other hazards are involved that may require additional protection. The following types of equipment are commonly used while conducting lead abatement activities:

Full-Body Protection

It is important to prevent lead dust from contaminating a worker's clothing. Once contaminated, the dust may cause a secondary exposure to the worker or be transported home to become a source of contamination in the home environment. Disposable suits provide protection from lead dusts accumulating on the worker's clothing . The suits should always be worn while conducting work that may generate lead dusts. The suits should be disposed of after each use and never reused.

Hand Protection

Hands may be exposed to both physical and chemical hazards. In paint abatement projects, removal and replacement techniques will expose workers to nails, wood, splinters, and other sharp objects. Chemical strippers may expose workers to materials that may damage their skin. Appropriate gloves are important to prevent injuries to a worker's hands. The type of glove will vary depending on the type of chemical being used or the type of physical exposure present.

Eye Protection

A worker wearing a face shield and/or goggles can protect the eyes and face from chemical splashes and dust. Workers who wear prescription glasses may be more comfortable using a full-face mask.

Hearing Protection

Depending on the type of power equipment being used, hearing protection may be needed to prevent exposure to excessive noise. If protective head coverings are required, ear inserts may be more comfortable than ear muffs. The type of protection will depend on the environment. A hearing conservation program must be implemented when noise exposures are at or above 85 dBA for an eight-hour day.

Respiratory Protection

Whenever administrative controls, engineering controls, or work practices cannot reduce the exposure below the PEL, respiratory protection may then be used to protect workers. Only NIOSH/MSHA approved respirators may be used when respiratory protection is needed. Respirators must be provided to employees at no cost, and the employer is responsible for making the appropriate selection. The concentration of lead and its physical state ultimately determine what type of respirator should be used. The first step in the selection process is to conduct an exposure assessment.

Each school district is required to determine whether any employee performing operations and maintenance (O&M) lead work is exposed to lead at or above the action level of 30 ug/m^3 as an eight-hour time-weighted average. Although this initial determination need not be based exclusively on air monitoring, it is recommended that workers have air monitoring performed in their breathing zone.

Representative air monitoring should be conducted for each type of employee exposure within the O&M activity. The school district, of course, is allowed to take individual exposure measurements of each employee if it chooses. When the representative monitoring is conducted, samples must be taken within the employee's breathing zone and must reflect the employee's exposure, without regard to the use of respirators, to airborne concentrations of lead over an eight- hour period.

In the past, the air lead levels that triggered certain respiratory protection were determined by employee exposure assessment, usually air monitoring. However, there is often a time lapse between taking the sample and receiving the results. Certain construction tasks are known to commonly produce exposures above the PEL. In such tasks, without sufficient protection, workers could be exposed to high concentrations of lead in the air during the period between sampling and receipt of the results. In addition, because many tasks to be performed are of short duration, workers could complete one job and go to the next job before monitoring results are received and the level of exposure known.

To address this problem, OSHA has included within the updated regulatory text three lists of tasks that trigger basic protective provisions before air monitoring.

The first set of tasks, consisting of those that commonly produce exposures between 50 ug/m^3 and 500 ug/m^3, includes manual demolition, manual scraping, manual sanding, heat gun applications, general cleanup, power tool cleaning with dust collection systems, and spray painting. When these tasks are performed, half-face air purifying respirators may be used.

The second category, from 500 ug/m^3 to 2,500 ug/m^3, includes the use of lead-containing mortar, lead burning, rivet busting, power tool cleaning without dust collection systems, cleanup of dry expendable abrasives, and abrasive blasting enclosure movement and removal. Power air-purifying respirators (PAPRs) are required when performing these tasks.

The final category requiring interim protection before receiving exposure assessment covers tasks commonly associated with air lead exposures greater than 2,500 ug/m^3. This category includes abrasive blasting as well as welding, cutting, and torch burning on steel structures. OSHA has chosen to be conservative and has assigned these tasks to its highest hazard category regarding required interim protection.

Respiratory protection will be used for conducting O&M lead work. However, respirators are the least preferred method of controlling airborne lead exposure, and they should not be used as the only means of preventing or minimizing exposures. Respiratory protection requirements are not an acceptable substitute for adequate training, supervision, appropriate engineering controls, and environmental or medical monitoring. Different respirators have different levels of protection. These are known as protection factors. The protection factors of various respirators are listed in the table below:

Types of Masks	**Protection Factor**
half-face air purifying	10
full-face air purifying (quantitative fit test)	50
powered air purifying respirator (PAPR) - full-face, tight fitting	50
supplied air - full-mask in continuous flow - half-face in pressure demand mode - full-face in pressure demand mode	50 1,000 2,000
self-contained breathing apparatus (SCBA) - full-face. pressure demand	+2,000

These protection factors are assigned by NIOSH and accepted by OSHA. The higher the protection factor, the greater the protection.

Written Respiratory Protection Program

Whenever respirators are used, either on a voluntary or mandatory basis, employers must establish a respiratory protection program. Respirators are devices that must be used carefully.

A minimally acceptable respiratory protection program must include selection of respirators on the basis of worker exposures; written standard operating procedures; training of employees in the proper use of respirators; fitting, regular cleaning, maintenance, and inspection of equipment; and storage in a clean and sanitary location. Workers must not be assigned to tasks requiring the use of respirators unless a physician has determined that they are physically able to perform the work and use the respirator. Under the OHSA construction lead standard, employers are required to:

- Provide, at no cost to an employee, respirators approved by NIOSH and the Mine Safety and Health Administration (MSHA) that will protect the employee against lead dust, fume, and mist.
- Select required respirators for employees based on the maximum airborne concentrations of lead, expected or measured.
- Provide, upon employee request, a power air-purifying respirator (PAPR) in lieu of the school district selected respirator, if this will provide sufficient protection.
- Ensure that the respirator issued to each employee fits properly and exhibits minimum face piece leakage.
- Perform qualitative or quantitative fit tests at the time of the initial fitting and at least every six months thereafter for employees wearing negative pressure respirators.
- Schedule a medical examination by a licensed physician before an employee receives clearance to wear a respirator. If an employee exhibits difficulty during fit testing or subsequent use, provide an appropriate medical examination to determine whether the employee can still wear a respirator while performing the job.
- Maintain an adequate supply of filters and instruct each employee to change the filter elements whenever an increase in breathing resistance is detected, if filter respirators are used.

Exposure Assessment

Each employer who has a workplace or operation covered by the Cal-OSHA standard shall initially determine whether any employee may be exposed to lead at or above the action level. This "exposure assessment" can include current results from exposure monitoring of employees, previous monitoring results, or other objective data demonstrating that the specific product, process, operation, or activity involving lead cannot result in exposures above the action level under any circumstances.

The exposure assessment is essential in identifying the exposure levels of certain tasks or jobs. Once the exposure levels are known, employers can then select the proper methods of control, work practices, PPE, etc. to provide the greatest level of protection to workers.

In general, the data collected to date indicate that workers are occasionally exposed to lead at levels greater than 50 ug/m^3 in most types of lead hazard control work and that exposures are highly variable. Practically speaking, this means that most lead hazard control workers will need protective measures, such as respirators and medical surveillance. Some forms of lead hazard control (such as wet cleaning) may require only minor worker protection measures while others may require more substantial measures.

OSHA has collected exposure data that are representative of employees' lead exposure levels (eight-hour, time-weighted average) for various construction activities, and the data are summarized in a table in the *Federal Register* (58 CFR, No. 84 May 4, 1993, Table 4, p. 26612). The standard recognizes that the exposure to lead during the work day may vary. Therefore, the Action Level and PEL are based on an eight-hour, time-weighted average. This means that the air sampling result is averaged over the entire work shift (even if the worker wasn't exposed to lead for part of the shift). For example, a worker could be exposed to a small amount of lead for eight hours and have the same sampling result as another worker who was exposed to a lot of lead for one hour but none for the remainder of the shift

The first step in conducting an exposure assessment is to make an initial determination regarding the exposure levels. The initial determination may be made through any of the following:

1. Employee monitoring representative of each job classification
2. Employee monitoring representative of the job classification the employer reasonably believes is exposed to the greatest airborne concentrations of lead
3. Previous monitoring results obtained within the past twelve months during work an operation that closely resembles the current operation, including type of material, control methods, work practices, and environmental conditions
4. Objective data demonstrating that a particular product or material containing lead or a specific process, operation, or activity involving lead cannot result in employee exposure at or above the action level. (The use of objective data is not permitted for exposure assessment in connection with any of the trigger activities.)

Trigger Activities

50-500 ug/m^3: Manual demolition of structures, manual scraping, manual sanding, heat gun applications, and power tool cleaning with HEPA filters.

500-2,500 ug/m^3: Using lead containing mortar, lead burning, rivet busting, power tool cleaning without filters, cleanup activities of abrasive blast, and abrasive blast enclosure movement and/or removal.

Above 2,500 ug/m^3: Abrasive blasting, welding, cutting and torch burning.

Negative Initial Determination

When the initial assessment shows that no employee is potentially exposed to lead at or above the action level (for one day or more), the determination is negative and further exposure assessments are not necessary until there is a change in the workplace.

Positive Initial Determination

When the initial assessment shows there is a potential for an employee to be exposed to lead at or above the action level (for one day or more), the determination is *positive* and exposure monitoring (or assessment with existing data) for **each individual** on the job must be conducted during representative work shifts. If the employer has previously monitored for lead exposure within the past twelve months--during work operations conducted under conditions closely resembling the current operation, with similar materials, control methods, work practices, and environmental conditions--the employer may rely on such earlier monitoring results to satisfy this requirement.

If the initial determination or subsequent determinations reveal the exposure to be at or above the action level but at or below the PEL, the employer shall perform monitoring every six months. The employer shall continue monitoring until at least two consecutive measurements taken at least seven days apart are below the action level; at that time, the employer may discontinue monitoring. Further monitoring is not required until there is a change in the workplace.

If the initial determination reveals that employee exposure is above the PEL, the employer shall perform quarterly monitoring. The employer shall continue monitoring until at least two consecutive measurements taken at least seven days apart are at or below the PEL but at or above the action level. The employer shall then monitor every six months. The employer shall continue monitoring until at least two consecutive measurements taken at least seven days apart are below the action level; at that time, the employer may discontinue monitoring. Further monitoring is not required until there is a change in the workplace.

Exposure Monitoring

Exposure monitoring refers to the personal monitoring and measurement of a worker's exposure to an airborne contaminant, regardless of what respiratory protection is worn. An air sample is collected outside a respirator worn as close to the worker's mouth and nose as is practical (often the collection device is worn on the shirt collar). Since the degree of worker protection provided may depend on the result of exposure monitoring, it is critical that the sampling be representative of the employee's regular, daily, and highest exposure to lead.

Medical Surveillance

Workers must undergo both initial and routine medical surveillance, depending on the level and duration of their airborne exposures to lead. The medical surveillance guidelines are outlined in Appendix C in 29 CFR 1926.62. All medical examination procedures must be under the supervision of a licensed physician, preferably one who is board certified in occupational health.

Initial Surveillance

One purpose of initial medical (or biological) monitoring is to establish baseline blood levels and to allow early detection of increases in worker blood levels. Another purpose is to detect workers who have already been overexposed to lead on previous jobs. OSHA requires employers to:

- Make initial biological monitoring available to all employees who are exposed on any single day to lead levels equal to or greater than 30 ug/m^3.
- Provide initial biological monitoring (blood tests) to all employees who will perform any trigger activities.
- Conduct biological monitoring of workers' blood levels and zinc protoporphyrin levels (zinc protoporphyrin levels are one way of measuring long-term exposures).
- Provide continued biological monitoring at least every two months until the employee has two consecutive blood lead level results that are less than 40 ug/dl. This monitoring is required when an employee's blood lead level is equal to or greater than 40 ug/dl.

Biological Monitoring Requirements

The employer must make available the following:

- Biological monitoring for blood lead and zinc protoporphyrin levels at least every two months for the first six months, and every six months thereafter.
- Biological monitoring when an employee's blood lead level is equal to or greater than 40 ug/dl. The biological monitoring must be conducted at least every two months until two consecutive blood lead level results are less than 40 ug/dl.
- Follow-up blood testing within two weeks when an employee's blood lead level meets the criterion for removal from the worksite (equal to or greater than 50 ug/dl).
- Monthly blood lead level testing during the removal period for any employee medically removed due to an elevated blood lead level (EBL).
- Blood lead sample analysis by an OSHA-approved laboratory.

Medical Examinations

The employer must:

- Provide medical examinations before assignments for workers whose exposure will be equal or greater than 30 ug/m^3 for more than thirty days per year.
- Make medical examinations available at least annually for any employee who had a blood level equal to or greater than 40 ug/dl any time during the past twelve months.
- Provide a medical examination as recommended by the treating physician for any employee who either has reported symptoms consistent with lead intoxication or upon employee request. Reasons that an employee may request a medical examination include medical advice related to conceiving a healthy baby, pregnancy, and difficulty in breathing during a respirator fit test.
- Furnish employees with written medical opinions from examining physicians.
- Make available medical examinations for employees medically removed from the job due to exposure to lead.
- Provide a multiple-physician review mechanism as specified in the standard 29 CFR 1926.26 (j) (3) (iii) to give workers the opportunity to obtain a second and possibly a third medical opinion.

Medical Removal Protection

The following are OSHA's basic medical removal protection requirements for construction employers:

- Remove employee on each occasion that a worker's periodic and follow-up blood lead levels are equal to or greater than 50 ug/dl; the employee can return to work when two consecutive blood lead levels are less than 40 ug/dl.
- Remove employee on each occasion when final medical determination indicates a medical condition that places the employee at "increased risk of material impairment to health" due to lead exposure.
- Implement protective recommendations for the employee that are included in the results of final medical determinations.
- Provide medical removal protection benefits for up to eighteen months, or as long as the job continues, each time an employee is removed.
- Maintain an employee's normal earnings, seniority, and other employment benefits during removal, including the right to return to the former work.

- Provide the same medical-removal protection benefits to any employee who is removed.

Work Practices and Hygiene

Definition of O&M lead work-- Work involving lead-containing materials performed in the course of routine maintenance activities, **not intended for the purpose of abatement.**

Although there are no concrete guidelines, at this time, that spell out what constitutes O&M work versus abatement, currently lead is treated much the same as AHERA treats asbestos. The above definition can be used as a common-sense approach to dealing with small amounts of paint, painted surfaces that need attention, or other tasks involving lead-containing materials, especially in situations where it is not practical to retain a lead abatement contractor.

Preparation of Work Area

The area shall be isolated with physical barriers and whenever possible, entry restricted to only persons necessary to perform the task. Warning signs will be posted at all entry points to the area. They should read:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

All HVAC ducts, windows, and other sources of air circulation to the area should be sealed. Where necessary, the air handling systems should be shut off and modified to meet this need. All movable objects should be removed from the area to protect them from contamination during the maintenance activity. Where it is not possible or feasible to move the objects, they should be completely covered with six mil polyethylene sheeting before the maintenance activity begins.

If paint has dislodged from its substrate and has contaminated an area, the entire area should be precleaned using wet methods and a HEPA vacuum. This should be done before performing the O&M work. All workers directly involved with the cleaning should always use the prescribed personal protective equipment.

Next, a layer of polyethylene sheeting should be placed on the floor beneath the item or area affected by the maintenance activity. This sheeting should be at least one foot wide and one foot long for each foot above the floor where the work is to be conducted but should not under any circumstances be less than six feet by six feet. For exterior work, poly sheeting should be placed under the area affected by the maintenance activity. The amount of poly sheeting should be adequate to capture all paint chips and dust generated by the work. If windy conditions are present, wind blocks should be constructed to minimize the effects of the wind or work should be postponed until the wind will not negatively affect the containment of the lead paint debris

Methods and Procedures for O&M Activities

For the purposes of O&M activities, concerning lead-based paint, it is important to consider what work needs to be done and for what reason. Activities considered abatement, which fall outside the definition of routine O&M work, should be done by workers who are certified by the California Department of Health Services (DHS) in lead-related construction work.

For most O&M activities involving lead-based paint, controlling the creation of lead-contaminated dust or debris, controlling the scattering of that dust, or cleaning the dust and debris created by work involves many of the same procedures. Tasks such as removing paint or paint chips, removing components from lead-painted surfaces, attaching items to lead-painted surfaces, or preparing a surface for painting should all start with misting or wetting the surface or area.

Using water or amended water with a Hudson-type sprayer or other appropriate applicator, the area should be lightly misted where the paint will be scraped. Time should be allowed for the water to soak into the material. This may take several passes with the sprayer. Be careful not to use too much water as excessive water can cause runoff and substrate damage. Scrape the lead-containing surfaces and trim to remove loose and peeling lead-based paint. Work should proceed carefully and deliberately to reduce the amount of dust generated.

To remove small amounts of paint, use a putty knife or scraper to slowly scrape the loose paint while keeping the area wet. Often, after small amounts are removed, an edge will need to be smoothed or feathered before repainting. Carefully chip or wet sand the edges until no loose paint remains on the surface. Basically, wet sanding consists of misting or wetting the material continually while the sanding is being done. If a lead-containing painted surface is in good condition, new paint can be applied over the old paint using normal methods.

When a small area of paint needs to be removed and the painted surface is undamaged, a utility knife can be used to make a cut around the area to be removed. Next, scrape the surface, keeping it wet. This method would be effective when removing a hinge, or something similar, from a door or cabinet that has been painted over. Cutting around the hinge will prevent quite a bit of chipping and will make removal of the hinge much easier.

When encountering a situation where paint must be removed and it is not peeling, a heat gun may be used to peel the paint. Once the paint begins to peel, use methods similar to those stated above. Prohibited methods of removal include open flame burning or heating of paint, dry abrasive blasting, and machine sanding. Although the use of solvents is a generally accepted method of removing lead-based paint, SISC recommends not using this method because of the potential problems involved in the disposal of the waste generated. Any waste generated from this type of removal is considered hazardous waste.

Once O&M activities, such as paint prep work, are finished, it is a good idea to put a coat of primer on the surface, especially if some paint remains. Because of the moisture from the removal of the loose paint and the fact that it is hard to stop peeling once it has begun, the chances of continued peeling are great if the surface is not sealed with a coat of primer or paint.

Soil that is known to be contaminated with lead should be wetted before it is disturbed. While wet, the soil can be raked to gather the paint chips and debris. When removing the soil, it should be thoroughly wetted before being placed in disposal bags with a thickness of six mil or greater.

At the completion of certain jobs, clearance dust wipe samples are recommended. For guidance and to determine whether wipe samples should be taken, contact the SISC Safety and Loss Control office.

There are many other O&M tasks not mentioned in this section. Keep in mind that no matter what the task being performed, keeping the material wet and containing the dust and debris are the most effective methods of preventing lead contamination while performing routine maintenance activities.

Cleanup and Clearance

At the completion of the O&M work, all poly sheeting used for containment should be HEPA vacuumed and wet wiped, tools and equipment used during the O&M procedures should be wet wiped, and personal protective equipment should be HEPA vacuumed. All of these items, once cleaned and/or vacuumed, can be disposed of as nonhazardous waste. All other items, such as paint debris and the contents of the HEPA vacuum, respirator cartridges, rags and mop heads used in the cleanup of the work area, etc., will generally be classified as hazardous waste. Contact the SlSC Safety and Loss Control office for assistance before the disposing of these items.

Proper cleanup is crucial since occupants, especially children, can develop severe poisoning if dust and debris are not cleaned up properly. Improperly conducted lead removal may result in a greater lead exposure for a child than if intact lead paint was left alone. Occupants should not be allowed to return until all work has been done properly and cleanup has been thorough. All surfaces from which lead-based paints have been stripped will be coated with a residue of lead dust that is very difficult to remove. Unless cleanup is thorough and complete, large amounts of nearly invisible lead dust can become embedded in the new paint. This lead will contaminate the site rather quickly if it is present on surfaces subject to abrasion, such as windows.

There are two basic methods of cleaning after abatement or O&M work that, when used concurrently, have proven most effective. The dry-cleaning method consists of using a HEPA vacuum to clean all surfaces in the area upon completion of the O&M activity. The wet cleaning method consists of using a 5%-10% trisodium phosphate (TSP) cleaning solution To perform wet cleaning, fill two buckets with the TSP solution. Dip and wring a clean cloth in the first bucket. Wipe off the area, then rinse the cloth in the first bucket and wring it thoroughly, then rinse the cloth in the second bucket and wring it before wiping the surface again. Continue to clean the work surface using this procedure until the entire surface appears to be clean. Rinse water should be changed periodically, depending on the amount of contamination. The work area affected should be dry cleaned, then wet cleaned, then dry cleaned again.

After the work activity is completed and the area has been thoroughly cleaned, clearance wipe samples must be taken. The purpose of the wipe samples is to ensure that school district personnel and students are not exposed to any lead dust. The clearance levels used are those established in the HUD Guidelines. They are as follows:

Area	Clearance Level
Interior floors	100 ug/ft^2
Window sills	500 ug/ft^2
Window wells	800 ug/ft^2
Exterior concrete floors	800 ug/ft^2
Soil-play areas	400 ppm
Soil-other areas	2,000 ppm

Personal Hygiene and Decontamination

Upon completion of the O&M activity, workers should go through a decontamination process. Showering and hand-washing are recognized as the most effective methods of minimizing the risk of spreading lead contamination. If showers are not used, then at a minimum, workers should follow complete decontamination procedures (including washing their hands with soap and water) whenever leaving the work area. It is especially important before consuming food or using tobacco products.

There should be no eating, drinking, smoking, chewing of gum or tobacco or applying cosmetics in the work area. All these things should be done in a clean area, separated from the work area. All workers must wash upon leaving the work area. Wash facilities should be available consisting of at least potable running water, soap. towels, and a HEPA vacuum. Upon leaving the work area, each worker will remove and dispose of disposable suits, wash and dry hands and face, and HEPA vacuum his/her disposable suit. This is the MINIMUM level of decontamination that should be used. If a shower is available, it is recommended that it be used.

Disposable clothing such as Tyvek suits and other personal protective equipment such as, but not limited to, head and hair, eye ear, face, and foot protection and gloves must be donned when required before entering the work area. A clean room or area should be available to put on suits, PPE, and to store street clothes. Disposable suits should only be used once and then discarded.

Waste Disposal

Lead waste is considered hazardous under certain conditions and must therefore be disposed of appropriately. Since each job may produce a different type of waste, it is important to consider the waste disposal issue before the job begins. Hazardous waste disposal is costly and in some instances the waste may be classified as nonhazardous. Therefore, it is important to include the waste disposal issue in the planning stages of a job to possibly avoid disposal costs. Lead waste (classified as hazardous) should be placed in clear poly bags and duct taped at the top to seal. The bags must be labeled to identify the contents and should be dated.

Waste items generally considered non-hazardous:

1. Protective suits that have been HEPA vacuumed
2. Poly sheeting that has been HEPA vacuumed and wet wiped
3. Decontaminated tools and equipment
4. Intact wood structural or decorative members with the paint adhering to the surface

Waste items generally considered hazardous:

1. Respirator cartridges
2. Any items that have not been decontaminated? for example, suits, tools, etc.
3. Loose paint chips and paint dust
4. Chemical residues used in paint removal
5. Abrasive blast residue
6. Contents of HEPA vacuums

Contact the SISC Safety and Loss Control office for assistance with waste disposal issues.

Responsibilities of School Districts

School districts have an important role to play in preventing lead poisoning of children. The following are some steps schools can take and some issues of which they should be aware.

1. Schools should be mindful that there may be lead paint hazards inside and outside buildings in public elementary schools, preschools, and child-care facilities. As paint ages and is disturbed, it can break down into small particles that can mix with dust. This dust can contaminate the interior areas of the school or the soil and asphalt near the walls of the building. **School officials should assume that lead paint is present in schools built prior to 1978.**

2. The safest course is not to disturb the paint in any way during normal maintenance and operations. Never sand, burn, or scrape paint unless it is known that the paint contains no lead. Emphasize the controlling of lead dust during normal maintenance. Also emphasize the cleanup of any dust using TSP or another high phosphate detergent and using HEFA vacuums.

3. Before beginning renovation or remodeling schools should evaluate the potential lead hazards and ensure that any work does not create an additional hazard by increasing lead in dust and debris.

   If there is obvious peeling or flaking paint or if remodeling or renovation is necessary, a potentially significant hazard exists or may be created for children and adults in the school.

4. Contractors must be certified through DHS, and the work must be conducted according to HUD guidelines and other regulatory standards. It is the school district's responsibility to ascertain that abatement personnel are state-certified. It is also the district's responsibility to determine whether the paint contains lead and to ensure the work is done properly.

Children should not be allowed in or near school buildings in which renovation activities may create lead dust.

5. When ordering or purchasing arts and crafts supplies for use in elementary school classrooms, be aware that these supplies can contain lead. Use only products approved by the Department of Education. Indoor firing ranges should also be monitored to determine the extent of lead exposure.

Chapter 9: Worker Protection

<u>Form 9.1</u>
<u>Model OSHA Written Compliance Plan</u>

Date: __/__/__

This plan has been developed to comply with the OSHA Construction Lead Standard, 29 CFR 1926.62.

1. Location of Project:

This job will take place at the residence located at___________________________(full address).

A previous lead inspection of this residence by________________________ (name and address of inspection or risk assessment firm) revealed that lead hazards or lead-based paint are present in the following locations:

_____________________(location and name of all building components to be treated)
____
____
____

These building components are coated with lead-based paint and represent a hazard to workers who may disturb it during lead hazard control renovation, or maintenance activities.

2. Brief Description of Job:

This job will involve the following lead hazard education measures (complete all that apply):

Replacement of ____(name all components)

Enclosure of ____ (name all components)

Paint removal of ____ (name all components)

Encapsulation of ____ (name all components)

Paint film stabilization of____________________________________ (name all components)

Friction surface treatments of ________________________________ (name all components)

Impact surface treatments of _________________________________(name all components)

Dust removal in the following areas: __________________________ (name all areas)

3. Schedule:

The job is expected to start on ___________________ (date) and end on ___________________(date). This compliance plan will take effect immediately on ___________________(date). The competent person will conduct worksite visual inspections on a daily basis.

Work will proceed according to the following schedule:

Day 1: Initial setup, followed by
___________________ (name all tasks to be completed)

____

____

Daily cleanup: wet mopping, HEPA vacuuming

Day 2: Tasks

Day 3: Tasks

Day 4: Final cleanup and clearance examination

4. Equipment and Materials:

HEPA vacuums, cleaning detergents, protective clothing, cotton work gloves, electric power saws, hammers, wrecking bars, pry bars, screwdrivers, plastic sheeting, metal scrapers, compressed air-powered water pumps, rollers, brushes. butyl rubber gloves. respirators, cutting shears, mops, plastic sheeting, paint brushes, paint rollers.

5. Crew:

The work will be completed by a crew of_______ (insert number) workers. Crew assignments are as follows:

Crew 1_____________ (name) _____________(task)

Crew 2 _____________(name) _____________(task)

6. Competent Person:

______________________(Name), a certified lead abatement supervisor, will be onsite at all times and will act as the competent person for occupational health and safety issues. The lead supervisor license (or certificate) number is:___________________. The lead supervisor will conduct daily inspections of the work areas to ensure that control measures, work practices, personal protective equipment, and hygiene facilities are used as prescribed in this document.

7. Control Measures:

The primary control methods for this project are (check all that apply):

_______method substitution (building component replacement, enclosure)
_______wet methods
_______wrapping materials to be discarded in plastic
_______respiratory protection
_______local exhaust ventilation (needle guns, vacuum blasting)
______ general room ventilation
______ on-the-job training
______ HEPA vacuums
______containment (use of plastic barriers)

8. Technology Considered in Meeting the Permissible Exposure Limit:

The HUD Guidelines for Evaluation and Control of Lead Hazards in Housing and Protecting Workers and Their Communities From Lead Hazards: A Guide for Protective Work Practices, published by the Society of Occupational and Environmental Health, and other publications were reviewed to determine the appropriate engineering controls to be used in this project. The only specialized equipment that will be utilized for this project are HEPA- filtered vacuum cleaners and ___________________ (name all special equipment).

9. Respirators:

All individuals in the work area will be provided with a NIOSH/MSHA-approved half-mask, air-purifying respirator equipped with HEPA cartridges or a powered air-purifying respirator (if so requested).

Respirators will be provided in the content of a complete respiratory protection program; the written respirator program is attached.

Respirators will be required during (name phases of job for which respirators will be required)
____
____
____

Respirator use during other activities, including initial setup (laying down plastic for containment), and enclosure and encapsulation after surface preparation is not necessary, *unless* other workers nearby (same interior room or outside wall) are performing activities for which respirators are required.

10. Protective Clothing:

Disposable protective clothing will be worn at all times inside the work area. Protective clothing will be made of breathable fabric to reduce the potential for worker heat stress. If visibly contaminated with dust or paint chips, protective clothing will be vacuumed before it is removed.

11. Hygiene Facilities:

Handwashing facilities will be used to decontaminate workers, since leaded dust levels are expected to be low. Showers are used on jobs that generate high leaded dust levels. The facilities will be located in a portable trailer, which will be parked in the driveway of the residence. The trailer will contain two sinks, a fresh water tank, hot water heater, wastewater collection tank, and easily cleanable floors and benches. Labeled plastic bins with covers will be used to separate disposable protective clothing from street clothing. Hot water, soap, and towels will be provided. Hands and face will be washed before all breaks and at the end of the day. Wastewater will be collected, pretreated onsite with filtration, and disposed of in accordance with prior arrangements made with ___________________(name of local water and sewage authority).

12. Air Monitoring Data:

Previous data for lead hazard control projects conducted with similar controls, environmental conditions, personnel, and methods were reviewed. Air sampling will not be performed on this job, since typical exposures have already been established for these work crews by:

___________________________(name of person or firm completing air sampling).

Based on these results, the major exposures to lead will occur during ______________(name tasks during which substantial exposures are likely to occur).

In previous work conducted by the same contractor and work crew on similar houses in the same city, using the same methods, *maximum* personal exposures measured for various activities were:

Maximum Exposure (ug/m^3)	**Task**

The environmental conditions in the homes previously abated closely resemble the current location. These maximum exposures are expected to represent "worst-case" exposures because they did not include breaks or setup time; it is expected that 8-hour, timed-weighted average exposures on this job will be lower than these figures. However, worker respiratory protection requirements will be based on the maximum exposures to allow for unexpected variations.

13. Medical Surveillance Program:

A medical surveillance program is already in place for this work crew. It is supervised by:
Dr.____(name, address, and phone number of physician and/or firm).

Worker blood lead levels are measured initially before the onset of work, each month for the first 6 months of employment, and every 6 months thereafter.

Blood lead levels for current employees who will be assigned to this job are between:

____ug/dL to __________ug/dL (list range of blood lead levels) based on the report dated ____________ (add date for latest medical monitoring report). Worker blood lead increases of 10 ug/dL or greater or any blood lead level greater than 25 ug/dL will trigger an investigation of protective equipment and work practices. All workers on this project are informed of their blood lead levels as soon as they are received.

14. Training:

The following workers have been trained using the EPA Worker Training Curriculum and SOEH's *Guide For Protective Work Practices and Effective Worker Training*. The training was conducted by ____(name, address, and phone number of training provider) on ____________________(insert date).

Trainees	**Social Security Number**
______________________________	______________________________
______________________________	______________________________
______________________________	______________________________

Plan completed by:
_________________(name and signature)
_________________(date)

Example of a Completed Worker Protection OSHA Compliance Plan

OSHA Written Compliance Plan

Date: 5/19/99

This plan has been developed to comply with the OSHA Construction Lead Standard, 29 CFR 1926.62.

1. Location of Project:

This job will take place at a private residence located at 2952 Channing Way, Anywhere, New York. A previous lead inspection of this residence by Carefree Consultants, Inc., revealed that windows, window frames, and all interior walls in both units are coated with lead-based paint (the range was 1.5 mg/cm^2 to 24 mg/cm^2). In some areas the existing lead-based paint is deteriorated, with loose and peeling paint chips. The existing lead-based paint represents a hazard to workers who may disturb it during lead hazard control or renovation activities.

2. ***Brief Description of Job:***

The abatement job will involve the removal and replacement of six windows In the residence and the encapsulation or enclosure of kitchen and bathroom walls.

The primary window replacement activities that are expected to generate leaded dust are manual removal of existing wood frame windows and cleaning.

3. ***Schedule:***

Work will proceed according to the following schedule:

Window Replacement

Day 1: Initial setup, including placement of plastic sheeting on interior floor and exterior ground surfaces for containment purposes.

Begin manual removal of windows. All window components will be wetted with water mist prior to removal to minimize dust generation.

Daily cleanup: wet sweeping, HEPA vacuuming

Day 2: Complete removal of all windows.

Preparation of window openings for replacement window—sawing or planing may be required.

Install replacement windows; employ daily cleanup as above.

Apply new caulking around replacement windows; final cleanup.

Encapsulation and Enclosure

Day 1: Initial setup, including placement of plastic sheeting on floors, and nonmovable furnishings, appliances, and furniture items.

Prepare surfaces to enclosure system by removing loose and peeling paint. All surface will be thoroughly wetted with water mist prior to scraping. Surfaces will be lightly scraped with 9-inch metal paint scrapers.

Daily cleanup: wet sweeping followed by HEPA vacuuming and mopping with detergent solution

Day 2: Install all mineral glass wallcovering material.

Manually apply the initial and final coats of the liquid encapsulant, polymer surfacing system over the mineral glass substrate. Rollers and brushes should be used to apply liquid encapsulant. Allow 8 hours to dry between coats, or until surface is hard and dry to the touch. Install enclosure system (drywall) over encapsulated surface.

Daily cleanup

Day 3: Final cleaning

4. Equipment and Material:

Window Replacement

"Olofson" metal frame, thermal-pane, replacement windows (Model 000-111), HEPA vacuums, trisodium phosphate detergent, protective clothing, cotton work gloves, electric power saws, hammers, wrecking bars, pry bars, screwdrivers, plastic sheeting, and other hand tools as needed.

The abatement job will also include encapsulation or enclosure of al1 interior walls in the kitchen and bathroom areas. The primary activities that are expected to generate leaded dust are manual scraping and cleaning involved with surface preparation.

Encapsulation and Enclosure

"Cover It Up" Encapsulant System (Item 333-55), drywall, metal scrapers, compressed air-powered water pumps, rollers, brushes, butyl rubber gloves, respirators, cutting shears, brooms, HEPA vacuums, detergent solution, mops, and plastic sheeting

The job is expected to start on July 11, 1999, and end on July 13, 1999. This compliance plan will take effect immediately on July 8, 1999. The competent person will conduct worksite visual inspections on a daily basis.

5. Crew:

The replacement of windows and encapsulation enclosure will each be completed by a crew of two workers. Crew assignments are as follows:

R. Smith, T. Jones	Crew 1, Window Replacement
Z. Topp, J. Gonzales	Crew 2, Encapsulation/Enclosure

6. Competent Person:

Mr. Homer Simpson, a licensed lead abatement supervisor, will be onsite at all times and will act as the competent person for occupational health and safety issues. Mr. Simpson's lead supervisor license number is: XMZ 678. Mr. Simpson will conduct daily inspections of the work areas to ensure that control measures, work practices, personal protective equipment, and hygiene facilities are used as prescribed in this document.

7. Control Measures:

Thc primary control method for this project is method substitution; that is, building component replacement and encapsulation and enclosure will be used for lead-based paint hazard abatement, instead of onsite paint removal.

During replacement, existing window frames, sashes, and troughs will be wetted with water mist prior to removal to reduce airborne dust generation during removal activities. During both replacement and encapsulation, all scraping or sawing activity will be done on wet surfaces; all debris will be wetted down before handling. Building components coated with lead based paint will be wrapped in plastic sheeting after removal to reduce contamination of workers' hands and clothing during handling and disposal. After initial surface preparation for encapsulation and window removal, it is expected that there will be minimal disturbance of existing lead coatings during this job. Wet methods (mopping) and HEPA vacuums will be used during cleaning to minimize worker exposures to lead.

To reduce generation of leaded dust in the work areas, paint chips and dust will be vacuumed on at least a daily basis with HEPA-filtered vacuums. Final cleaning will be accomplished by three successive cleanings consisting of HEPA vacuuming alternated with wet mopping with trisodium phosphate solution. The use of HEPA vacuums and wet cleaning methods will minimize worker lead exposures.

8. Technology Considered in Meeting the Permissible Exposure Limit:

The HUD *Guidelines for Evaluation and Control of Lead Hazards in Housing* and other publications were reviewed to determine the appropriate engineering controls to be used in this project. The only specialized equipment that will be utilized for this project are HEPA-filtered vacuum cleaners and air-powered water pumps with high-pressure hoses attached to aerosol-generating nozzles (for water misting of surfaces). Natural ventilation will be utilized, as mechanical ventilation with HEPA-filtered exhaust fans has not been found to reduce worker lead exposures with the methods that will be used during this project.

9. Respirators:

All individuals in the work area will be provided with a half-mask, air-purifying respirator equipped with HEPA cartridges or a powered air-purifying respirator if so requested. Respirators will be provided in the context of a complete respiratory protection program; the written respirator program is attached.

Respirators will be required during window removal, surface preparation for encapsulation, any sawing or use of power tools, manual scraping, cleaning activities, and final cleanup. Respirator use during other activities, including initial setup (such as laying down plastic for containment), and enclosure and encapsulation after surface preparation is not necessary, *unless* other workers nearby (same interior room or outside wall) are performing activities for which respirators are required.

10. Protective Clothing:

Disposable protective clothing will be worn at all times inside the work area. Protective clothing will be made of breathable fabric to reduce the potential for worker heat stress. If visibly contaminated with paint dust or chips, protective clothing will be vacuumed before it is removed.

11. Hygiene Facilities:

Handwashing facilities will be used to decontaminate workers. The facilities will be located in a portable trailer that will be parked in the driveway or parking area of the residence. The trailer will contain two sinks, a fresh water tank, hot water heater, wastewater collection tank, and easily cleanable floors and benches. Labeled plastic bins with covers will be used to separate disposable protective clothing from street clothing. Hot water, soap, and towels will be provided. Hands and face will be washed before all breaks and at the end of the day. Wastewater will be collected, pretreated onsite with filtration, and disposed of in accordance with prior arrangements made with the Anywhere Municipal Wastewater Treatment Facility. The trailer will be cleaned with a HEPA vacuum and wet washed twice each week.

12. Air Monitoring Data:

Previous data for lead abatement projects conducted with similar controls, environmental conditions, personnel, and methods were reviewed. Air sampling will not be performed on this job, since typical exposures have already been established for these work crews (see attached report from previous jobs prepared by XYZ Industrial Hygiene, Inc.). Based on these results, the major exposures to lead will occur during window removal, although significant exposures may also occur during cleanup.

In previous work conducted by the same contractor and work crew on similar houses in the same city, using the same methods, *maximum* personal exposures measured for various activities were: window removal and replacement, 121 ug/m^3; encapsulation, 24 ug/m^3; cleaning, 110 ug/m^3; final cleaning, 50 ug/m^3; and initial setup, 6 ug/$m^{3.}$ The environmental conditions in the homes previously abated closely resemble the current location. These maximum exposures are expected to represent "worst-case" exposures because they did not include breaks or setup time: it is expected that 8-hour, time-weighted average exposures on this job will be lower than these figures. However, worker respiratory protection requirements will be based on the maximum exposures to allow for unexpected variations.

13. Medical Surveillance Program:

A medical surveillance program is already in place for this work crew. It is supervised by Dr. William Jones, a board-certified occupational health physician with Occupational Health Clinic, Inc. (phone: 800-555-1111). Worker blood lead levels are measured initially before the onset of work, each month for the first 6 months of employment, and every 6 months thereafter. Blood lead levels for current employees who will be assigned to this job are 5-12 ug/dL, based on the May report (see attached). Worker blood lead increases of 10 ug/dL or more will trigger an investigation of protective equipment and work practices. All workers on this project are informed of their blood lead level as soon as they are received.

14. Training:

All workers have been trained using the EPA Worker Training Curriculum. The training was conducted by Joe Smith, a certified industrial hygienist with XYZ Industrial Hygiene, Inc., and Bill Smith, the competent person, on March 3-5, 1993.

Workers trained on March 3-5 include:

R. Smith

T. Jones

Z. Topp

J. Gonzales

The job proceeded as planned. However, in the next month, one worker's blood lead level increased from 12 to 25 ug/dL This employee was one of the most productive members of the crew. The employer investigated the possible causes of the increase (10 ug/dL or more). After observing and interviewing the worker on a subsequent job, it was clear that the worker was not wearing the half-mask, air-purifying respirator all the time and was not using enough water to moisten surfaces before scraping. A powered air-purifying respirator was provided to increase the worker's understanding of the need for respiratory protection. Additional training and counseling by the physician was also provided to this individual. The following month's blood lead level declined to 16 ug/dL, but the supervisor continued to conduct special oversight of this individual.

Plan completed by:

_____________________________(name)

_____________________________(signature)

_____________________________(date)